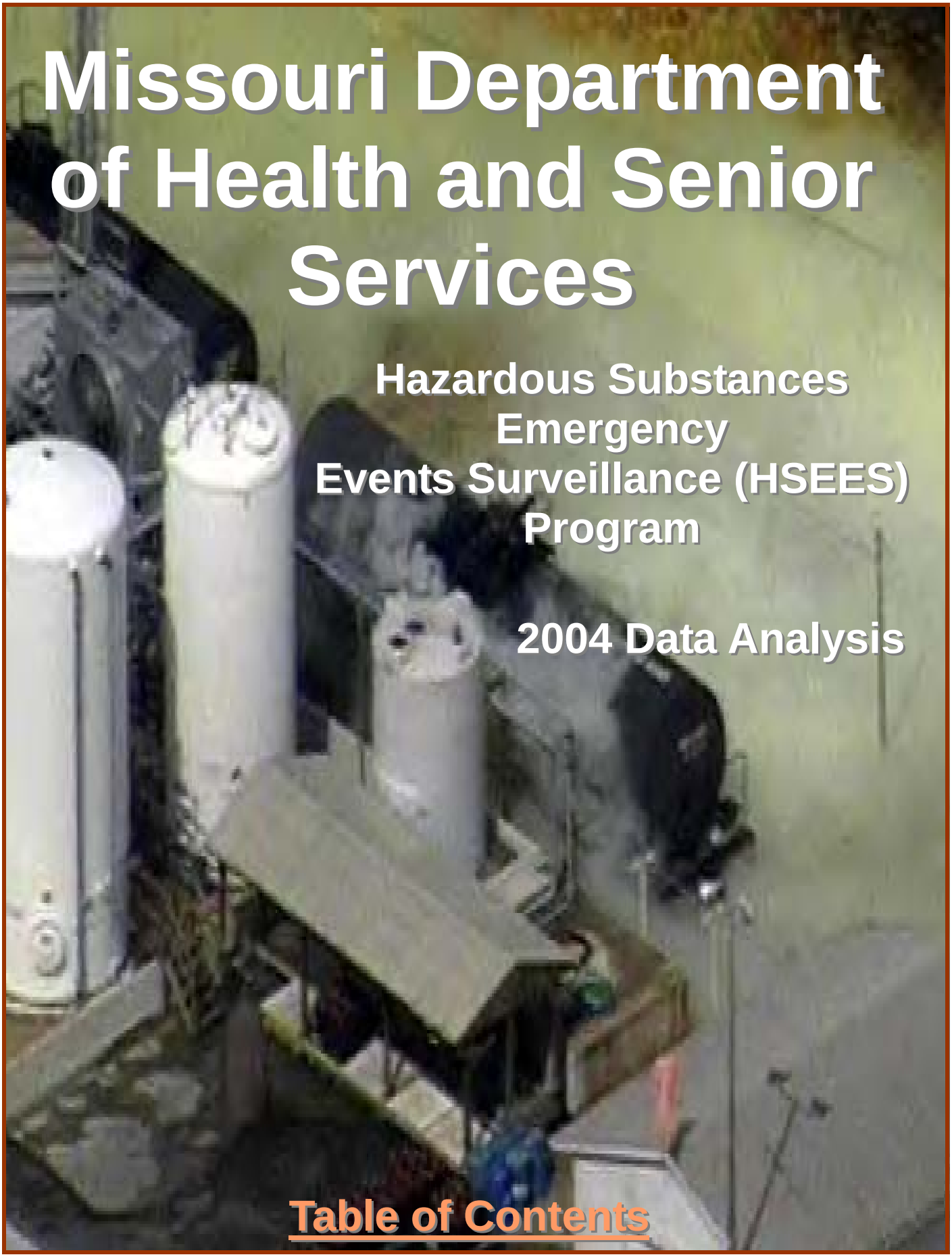

Missouri Department of Health and Senior Services

Hazardous Substances Emergency Events Surveillance (HSEES) Program

2004 Data Analysis

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EXECUTIVE SUMMARY

The Hazardous Substances Emergency Events Surveillance (HSEES) system, maintained by the Agency for Toxic Substances and Disease Registry (ATSDR), actively collects information to describe the public health consequences of acute releases of hazardous substances in participating states. This report summarizes the characteristics of events reported to the Missouri Department of Health and Senior Services (MDHSS) in 2004. Information about acute events involving hazardous substances was collected, including the substance(s) released, number of victims, number and types of injuries, and number of evacuations. The data were computerized using an ATSDR-provided web-based data entry system.

During 2004, a total of 300 events were reported. In 253 (84%) events, only one substance was released. The most commonly reported categories of substances were other inorganic substances, volatile organic compounds, and acids. During this reporting period, 94 events (31% of all reported events) resulted in a total of 140 victims, of whom 2 (1%) died. The most frequently reported injuries were respiratory irritation, headache, and dizziness/central nervous system symptoms. Evacuations were ordered for 21 (7%) events.

The findings regarding the percentage of events with victims have fluctuated in recent years. The most common two types of injuries reported have consistently been respiratory irritation and headache, followed by eye irritation and dizziness/central nervous system symptoms. Prevention outreach efforts for 2004 focused on quarterly reports of the 10 counties with the highest number of events, 2003 annual report, 2003 event summary reports by county and an analyses of acute releases of chemicals involved in improper loading/unloading and forklift punctures.

INTRODUCTION

The Centers for Disease Control and Prevention defines surveillance as the

> "ongoing, systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know. The final link of the surveillance chain is the application of these data to prevention and control. A surveillance system includes a functional capacity for data collection, analysis, and dissemination linked to public health programs" [1].

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the public health consequences of releases of hazardous substances. The decision to initiate a surveillance system of this type was based on a study published in 1989 about the reporting of hazardous substances releases to three national databases: the National Response Center Database (NRC), the Hazardous Material Information System (HMIS), and the Acute Hazardous Events Database [2]. A review of these databases indicated limitations. Many events were missed because of specific reporting requirements (for example, the HMIS did not record events involving intrastate carriers or fixed-facility events). Other important information was not recorded, such as the demographic characteristics of victims, the types of injuries sustained, and the number of persons evacuated. As a result of this review, ATSDR implemented the HSEES system to more fully describe the public health consequences of releases of hazardous substances. HSEES has several goals:

- To describe the distribution and characteristics of acute hazardous substances releases;
- To describe morbidity and mortality among employees, responders, and the general public that resulted from hazardous substances releases; and
- To develop strategies that might reduce future morbidity and mortality resulting from the release of hazardous substances.

For a surveillance system to be useful, it must not only be a repository for data, but the data must also be used to protect public health.

In the last few years, the last goal of the HSEES system has been emphasized; i.e., to develop strategies to reduce subsequent morbidity and mortality by having each participating state analyze its data and develop appropriate prevention outreach activities. These activities are intended to provide industry, responders, and the general public with information that can help prevent chemical releases and reduce morbidity and mortality if a release occurs.

This report provides an overview of HSEES for 2004 in Missouri (MO), summarizes the characteristics of acute releases of hazardous substances and their associated public health consequences, and demonstrates how data from the system are translated into prevention activities to protect public health.

METHODS

In 2004, thirteen state health departments participated in HSEES: Colorado, Iowa, Louisiana, Minnesota, Missouri, New Jersey, New York, North Carolina, Oregon, Texas, Utah, Washington, and Wisconsin.

Beginning in 2002, a newly updated data-collection form, approved by the Office of Management and Budget, went into effect. Information was collected about each event, including substance (s) released, victims, injuries (adverse health effects and symptoms), and evacuations.

Various data sources were used by MO HSEES to obtain information about these events. These sources included but were not limited to MO Department of Natural Resources (DNR), United States Coast Guard NRC, MDHSS Bioterrorism Surveillance, United States Department of Transportation (DOT) HMIS, MO State Highway Patrol (MSHP), private companies and MO Press Clipping Bureau (media). Census data were used to estimate the number of residents in the vicinity of most of the events. All data were computerized using a web-based data entry system provided by ATSDR.

HSEES defines hazardous substances emergency events as acute uncontrolled or illegal releases or threatened releases of hazardous substances. Events involving releases of only petroleum are excluded. Events are included if (a) the amount of substance released (or that might have been released) needed (or would have needed) to be removed, cleaned up, or neutralized according to federal, state, or local law or (b) the release of a substance was threatened, but the threat led to an action (for example, evacuation) that could have affected the health of employees, emergency responders, or members of the general public. HSEES defines victims as people who experience at least one documented adverse health effect within 24 hours after the event or who die as a consequence of the event. Victims who receive more than one type of injury or symptom are counted once in each applicable injury type or symptom. Events are defined as transportation-related if they occur (a) during surface, air, pipeline, or water transport of hazardous substances, or (b) before being unloaded from a vehicle or vessel. All other events are considered fixed-facility events.

For data analyses, the substances released were categorized into 16 groups. The category “mixture” comprises substances from different categories that were mixed or formed from a reaction before the event; the category “other inorganic substances” comprises all inorganic substances except acids, bases, ammonia, and chlorine; and the category “other” comprises substances that could not grouped into one of the other existing categories.

RESULTS

For 2004, a total of 300 acute hazardous substances events were captured by MO HSEES. One (0.3%) of these events was a threatened release. The counties with the most frequent number of events were St. Charles (31 [10%]) and Jackson (30 [10%]) (Table 1).

Table 1. - Number of events meeting the surveillance definition, by county and type of event - Missouri Hazardous Substances Emergency Events Surveillance, 2004

County	Type of event				All events
	Fixed facility		Transportation		
	No. events	%*	No. events	%*	Total no. events (%)
Adair	1	0.7%	0	0%	1 (0.3%)
Andrew	0	0%	1	0.7%	1 (0.3%)
Barry	0	0%	1	0.7%	1 (0.3%)
Barton	1	0.7%	0	0%	1 (0.3%)
Bollinger	1	0.7%	0	0%	1 (0.3%)
Boone	3	2%	4	3%	7 (2%)
Buchanan	4	3%	1	0.7%	5 (2%)
Butler	1	0.7%	0	0%	1 (0.3%)
Caldwell	1	0.7%	0	0%	1 (0.3%)
Camden	1	0.7%	2	1%	3 (1%)
Cape Girardeau	2	1%	1	0.7%	3 (1%)
Carroll	0	0%	1	0.7%	1 (0.3%)
Carter	0	0%	1	0.7%	1 (0.3%)
Cass	3	2%	2	1%	5 (2%)
Christian	3	2%	2	1%	5 (2%)
Clay	2	1%	2	1%	4 (1%)
Clinton	0	0%	1	0.7%	1 (0.3%)
Cole	2	1%	0	0%	2 (0.7%)
Cooper	1	0.7%	1	0.7%	2 (0.7%)
Crawford	2	1%	0	0%	2 (0.7%)
Dade	1	0.7%	1	0.7%	2 (0.7%)
Dallas	2	1%	0	0%	2 (0.7%)
Daviess	1	0.7%	0	0%	1 (0.3%)
Dent	1	0.7%	0	0%	1 (0.3%)

Table 1. - Number of events meeting the surveillance definition, by county and type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004

County	Type of event				All events
	Fixed facility		Transportation		
	No. events	%*	No. events	%*	Total no. events (%)
Dunklin	2	1%	1	0.70%	3 (1%)
Franklin	4	3%	3	2%	7 (2%)
Greene	11	7%	12	8%	23 (8%)
Harrison	1	0.70%	0	0%	1 (0.3%)
Hickory	0	0%	1	0.70%	1 (0.3%)
Holt	0	0%	1	0.70%	1 (0.3%)
Howell	1	0.70%	0	0%	1 (0.3%)
Iron	1	0.70%	2	1%	3 (1%)
Jackson	13	9%	17	11%	30 (10%)
Jasper	7	5%	4	3%	11 (4%)
Jefferson	3	2%	2	1%	5 (2%)
Johnson	1	0.70%	0	0%	1 (0.3%)
Knox	1	0.70%	0	0%	1 (0.3%)
Lafayette	1	0.70%	1	0.70%	2 (0.7%)
Lawrence	6	4%	1	0.70%	7 (2%)
Lewis	1	0.70%	0	0%	1 (0.3%)
Livingston	2	1%	0	0%	2 (0.7%)
Macon	2	1%	1	0.70%	3 (1%)
Marion	4	3%	3	2%	7 (2%)
McDonald	1	0.70%	1	0.70%	2 (0.7%)
Mercer	1	0.70%	0	0%	1 (0.3%)
Monroe	0	0%	1	0.70%	1 (0.3%)
New Madrid	2	1%	0	0%	2 (0.7%)
Newton	3	2%	2	1%	5 (2%)
Osage	2	1%	0	0%	2 (0.7%)
Pemiscot	1	0.70%	0	0%	1 (0.3%)
Pettis	6	4%	0	0%	6 (2%)

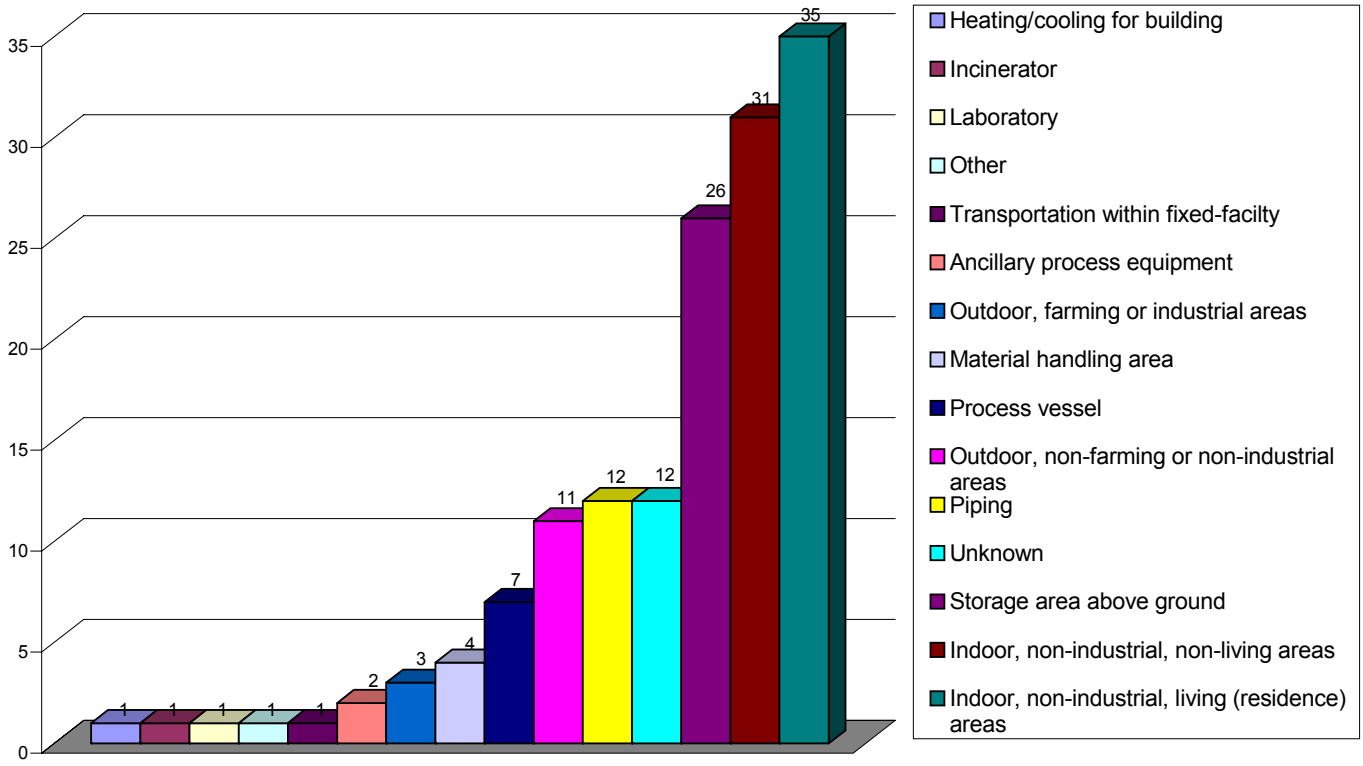
Table 1. - Number of events meeting the surveillance definition, by county and type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004

County	Type of event				All events
	Fixed facility		Transportation		
	No. events	%*	No. events	%*	Total no. events (%)
Phelps	0	0%	1	0.70%	1 (0.3%)
Pike	1	0.70%	0	0%	1 (0.3%)
Platte	0	0%	1	0.70%	1 (0.3%)
Pulaski	0	0%	2	1%	2 (0.7%)
Ray	1	0.70%	0	0%	1 (0.3%)
Reynolds	1	0.70%	0	0%	1 (0.3%)
Saline	1	0.70%	0	0%	1 (0.3%)
Scotland	1	0.70%	0	0%	1 (0.3%)
Scott	2	1%	2	1%	4 (1%)
Shelby	0	0%	2	1%	2 (0.7%)
St. Charles	3	2%	28	18%	31 (10%)
St. Francois	5	3%	0	0%	5 (2%)
St. Louis	11	7%	15	10%	26 (9%)
St. Louis City	2	1%	17	11%	19 (6%)
Ste. Genevieve	1	0.70%	2	1%	3 (1%)
Stoddard	0	0%	1	0.70%	1 (0.3%)
Stone	2	1%	2	1%	4 (1%)
Sullivan	2	1%	0	0%	2 (0.7%)
Taney	0	0%	2	1%	2 (0.7%)
Vernon	2	1%	2	1%	4 (1%)
Washington	2	1%	1	0.70%	3 (1%)
Wayne	1	0.70%	0	0%	1 (0.3%)
	148	**94.90%**	**152**	**96.70%**	**300**

* Percentage = (number of events by type of event per county ÷ total number of events in that county) x 100

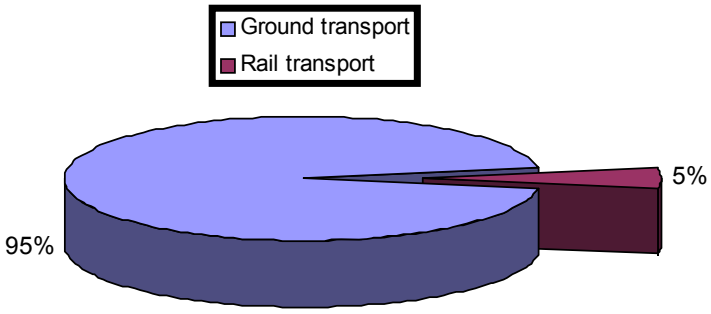
A total of 148 (49%) events occurred in fixed facilities. For each fixed-facility event, one or two types of area or equipment involved in the fixed facility where the event occurred could be selected. Of all 148 fixed-facility events, 134 (91%) reported one type of area and 2 (1%) reported a combination of two area types. Type of area was not reported for 12 (8%) events. Among events with one type of area reported, the main areas were classified as follows: 35 (26%) indoor, non-industrial, living (residence) areas, 31 (23%) indoor, non-industrial, non-living areas, and 26 (19%) storage area above ground (i.e. warehouse, tank, storage shed) (Figure 1).

Figure 1. - Areas of fixed facilities involved in events
Missouri Hazardous Substances Emergency Events Surveillance, 2004



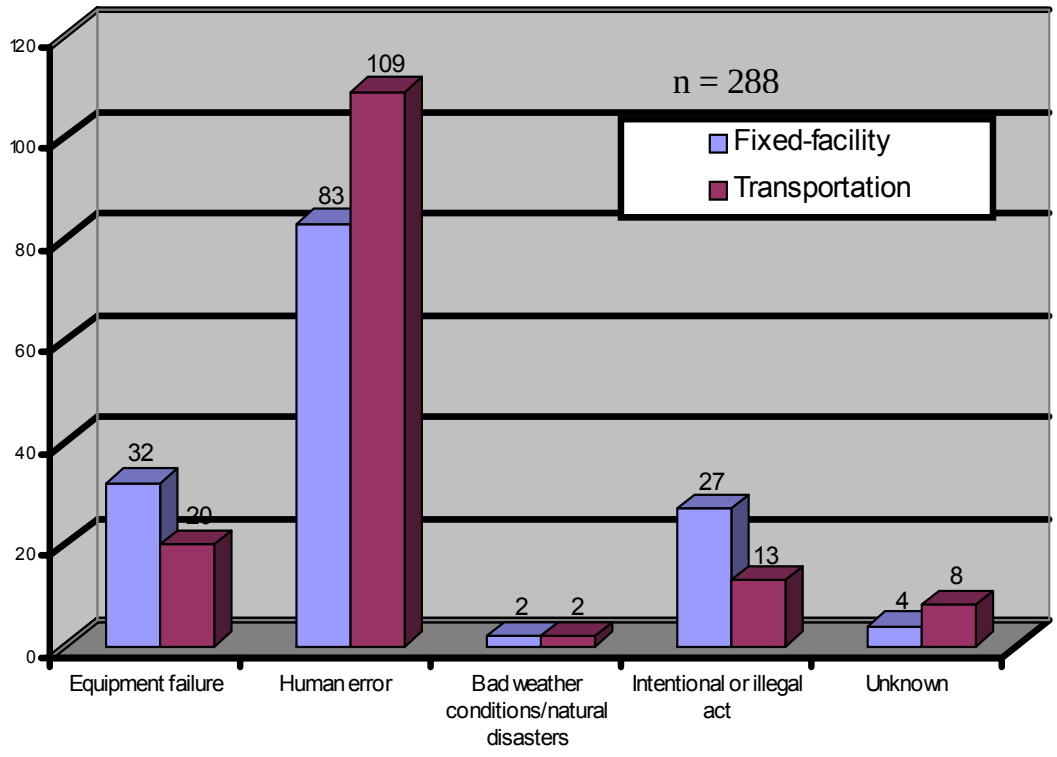
Of the 152 transportation-related events, 144 (95%) occurred during ground transport (e.g., truck, van, automobile or tractor) and 8 (5%) involved transport by rail (Figure 2). No events involved water, air, and pipeline transportation modes. Most (86%) ground transportation events involved trucks. The largest proportions of transportation-related events occurred during unloading of a stationary vehicle or vessel (65 [43%]) and from a moving vehicle or vessel (38 [25%]). Of the 152 transportation-related events, 33 (22%) involved a release en route that was later discovered at a fixed facility.

Figure 2. - Distribution of transportation-related events, by type of transport
Missouri Hazardous Substances Emergency Events Surveillance, 2004



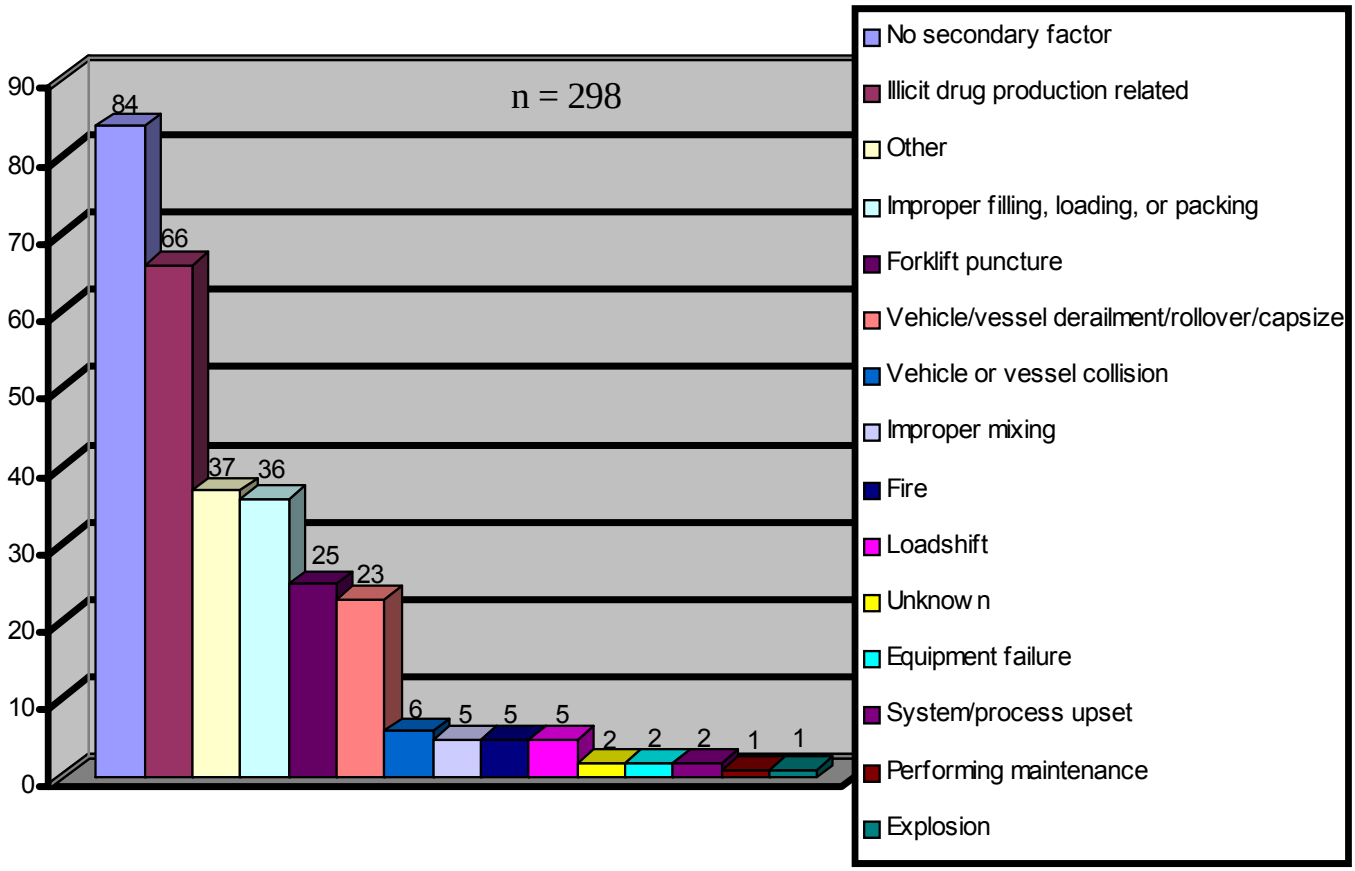
Factors contributing to the events consisted of primary and secondary entries. Primary factors were reported for 288 (96%) events (Figure 3a). Of the reported primary factors, most (29%) fixed-facility and most (38%) transportation-related events involved human error.

Figure 3a. - Primary factors reported as contributing to events by event type
Missouri Hazardous Substances Emergency Events Surveillance, 2004



Secondary factors were reported for 214 (77%) events (Figure 3b). Of the reported secondary factors, most (24%) fixed-facility events involved illicit drug production, and most (16%) transportation-related events involved improper filling, loading or packing.

Figure 3b. - Secondary factors reported as contributing to events
Missouri Hazardous Substances Emergency Events Surveillance, 2004



Of the 299 events involving actual releases, 253 (85%) involved the release of only one substance. Two substances were released in 12 (4%) of the events, and approximately 34 (11%) involved the release of more than two substances (Table 2). Fixed-facility events were more likely than transportation events to have two or more substances released in an event (24% vs. 7%).

The number of events by month ranged from 14 (5%) in October to 39 (13%) in April, with the largest proportions occurring from March through May. The proportion of events ranged from 15% to 20% during weekdays, and 6% during weekend days. Of all 278 (93%) events for which time of day or time category was reported, 30% occurred from 6:00 AM to 11:59 AM, 28% from 12:00 PM to 5:59 PM, 18% from 6:00 PM to 11:59 PM, and the remainder during the early hours of the day.

**Table 2. - Number of substances involved per event, by type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004**

No. substances	Type of event						All events		
	Fixed facility			Transportation					
	No. events	%*	Total substances	No. events	%*	Total substances	No. events	%	Total substances
1	113	76%	113	140	93%	140	253	85%	253
2	11	7%	22	1	0.7%	2	12	4%	24
3	11	7%	33	8	5%	24	19	6%	57
4	10	7%	40	2	1%	8	12	4%	48
≥ 5	3	2%	21	0	0%	0	3	1%	21
Total	**148**	**99%**	**229**	**151**	**99.7%**	**174**	**299**	**100%**	**403**

*Percentage does not equal 100% due to rounding.

Industries

The largest proportions of HSEES events were associated with the transportation (107 [36%]) and illegal activity (illicit drug-related) (66 [22%]) industries (Table 3). The largest number of events with victims occurred from the illegal activity (illicit drug-related) industry (53 [56%]). The total number of victims was greatest in the illegal activity (illicit drug-related) industry (79 [56%]) followed by the number of victims in manufacturing (27 [19%]) and professional services (8 [6%]). The industry with the most events may not necessarily be the most likely to result in victims. For example, the transportation industry was involved in 107 events; however, only 7 of these events (7%) resulted in adverse health effects. Conversely, the illegal activity (illicit drug related activity) industry was involved in only 66 events, and 53 of these events (80%) resulted in adverse health effects, indicating its greater potential for immediate harm.

Table 3. - Industries involved in hazardous substance events, by category
Missouri Hazardous Substances Emergency Events Surveillance, 2004

Industry category	Total events		Events with victims		Percentage of events with victims	Total no. victims Number (maximum)
	No.	%‡	No.	%‡		
Abandoned†	0	0%	0	0%	0%	0
Agriculture	7	2%	1	1%	14%	1
Business and repair services	3	1%	2	2%	67%	2
Communication	0	0%	0	0%	0%	0
Construction	3	1%	0	0%	0%	0
Entertainment	2	0.7%	0	0%	0%	0
Finance and Real estate	1	0.3%	1	1%	100%	1
Illegal activity (illicit drug related)	66	22%	53	56%	80%	79
Illegal activity (non-illicit drug related)	3	1%	0	0%	0%	0
Manufacturing	37	12%	10	11%	27%	27
Mining	4	1%	2	2%	50%	2
Personal services	15	5%	3	3%	20%	4
Private vehicle or property	3	1%	0	0%	0%	0
Professional services	16	5%	6	6%	38%	8
Public administration	4	1%	2	2%	50%	2
Retail trade	6	2%	4	4%	67%	4
Transportation	107	36%	7	7%	7%	7
Unspecified and unknown	2	0.7%	0	0%	0%	0
Utilities	12	4%	1	1%	8%	2
Wholesale trade	9	3%	2	2%	22%	2
Total	**300**	**98.7%**	**94**	**98%**	**31%**	**140**

* Minimum number of victims per event = 1.
† Includes chemical dumped on highway or other property and currently non-operating former businesses.
‡ Percentage does not equal 100% due to rounding.

Substances

A total of 404 substances were involved in all events, of which 1 (0.2%) substance was reported as threatened to be released. The individual substances most frequently released were ammonia, hydrochloric acid, mercury, and acetone (Appendix A). Substances were grouped into 16 categories. The substance categories most commonly released in fixed-facility events were other inorganic substances (54 [24%]), acids (38 [17%]), and volatile organic compounds (37 [16%]) (Table 4). In transportation-related events, the most common substance categories released were volatile organic compounds (35 [20%]), acids (25 [14%]), and other inorganic substances (25 [14%]).

Table 4. - Number of substances involved, by substance category and type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004

Substance category	Type of event				All events	
	Fixed facility		Transportation			
	No. substances	%¶	No. substances	%¶	No. substances	%¶
Acids	38	17%	25	14%	63	16%
Ammonia	32	14%	11	6%	43	11%
Bases	15	7%	14	8%	29	7%
Chlorine	7	3%	2	1%	9	2%
Formulations	1	0.4%	0	0%	1	0.2%
Hetero-organics	1	0.4%	0	0%	1	0.2%
Hydrocarbons	1	0.4%	1	0.6%	2	0.5%
Mixture*	11	5%	9	5%	20	5%
Other†	21	9%	9	5%	30	7%
Other inorganic substances‡	54	24%	25	14%	79	20%
Oxy-organics	5	2%	11	6%	16	4%
Paints and dyes	0	0%	9	5%	9	2%
Pesticides	5	2%	10	6%	15	4%
Polychlorinated biphenyls	0	0%	2	1%	2	0.5%
Polymers	1	0.4%	11	6%	12	3%
Volatile organic compounds	37	16%	35	20%	72	18%
Total	**229**	**100.6%**	**174**	**97.6%**	**403**	**100.4%**

* Substances from different categories that were mixed or formed from a reaction before the event.
† Not belonging to one of the existing categories.
‡ All inorganic substances except for acids, bases, ammonia, and chlorine.
¶ Percentages do not total 100% because of rounding.

Two types of releases for each substance (e.g., spill and volatilization) could be reported. Only one type of release was associated with the following: air releases (178 [49%]), spills (178 [49%]), fire (6 [2%]), threatened release (1 [0.2%]), explosion (1 [0.2%]), and radiation (1 [0.2%]). Of events with two types of releases, the following combinations were reported: spill and air (37 [95%]), spill and fire (1[3%]), air and explosion (1 [3%]).

Victims

A total of 140 victims were involved in 94 events (31% of all events) (Table 5). Of the 94 events with victims, 73 (78%) events involved only one victim, and 13 (14%) involved two victims. Of all victims, 105 (75%) were injured in fixed-facility events. Fixed-facility events were more likely to have three or more victims per event (6%) than were transportation-related events (2%). Additionally, 18 persons in 5 events (2% of all events) were observed at a hospital or medical facility, however they did not have symptoms resulting from the event and, therefore, were not counted as victims.

Table 5. - Number of victims per event, by type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004

No. victims	Type of event						All events		
	Fixed facility			Transportation					
	No. events	%	Total victims	No. events	%	Total victims	No. events	%	Total victims
1	55	80%	55	18	72%	18	73	78%	73
2	8	12%	16	5	20%	10	13	14%	26
3	2	3%	6	1	4%	3	3	3%	9
4	1	1%	4	1	4%	4	2	2%	8
5	1	1%	5	0	0%	0	1	1%	5
≥6	2	3%	19	0	0%	0	2	2%	19
Total	**69**	**100%**	**105**	**25**	**100%**	**35**	**94**	**100%**	**140**

To represent the magnitude of the effects of substances involved in injuries, the number of events in a specific substance category was compared with the number of events in the same category that resulted in victims. In events that involved one or more substances from the same substance category, substances were counted once in that category. In events that involved two or more substances from different categories, substances were counted once in the multiple substance category. Substances released most often were not necessarily the most likely to result in victims (Table 6). For example, events categorized as other inorganic substances constituted 14% of all events; however, only 17% of these events resulted in injuries. Conversely, events involving bases accounted for 7% of all events respectively, but 45% resulted in injuries.

**Table 6. - Frequency of substance categories in all events and events with victims
Missouri Hazardous Substances Emergency Events Surveillance System, 2004***

Substance category	All events		Events with victims		
	No.	%¶	No.	Percentage of all releases with victims¶	Percentage of events with victims in substance category¶
Acids	28	9%	5	5%	18%
Ammonia	33	11%	9	10%	27%
Bases	22	7%	10	11%	45%
Chlorine	8	3%	1	1%	13%
Formulations	1	0.3%	0	0%	0%
Hetero-organics	1	0.3%	0	0%	0%
Hydrocarbons	2	0.7%	1	1%	50%
Mixture†	18	6%	4	4%	22%
Multiple substance category	45	15%	44	47%	98%
Other‡	13	4%	5	5%	38%
Other inorganic substances§	42	14%	7	7%	17%
Oxy-organics	15	5%	1	1%	7%
Paints and dyes	9	3%	0	0%	0%
Pesticides	14	5%	1	1%	7%
Polychlorinated biphenyls	2	0.7%	0	0%	0%
Polymers	12	4%	1	1%	8%
Volatile organic compounds	34	11%	5	5%	15%
Total	**299**	**99%**	**94**	**99%**	**31%**

* Substances in events that involved multiple substances were counted only once in a substance category when all the substances were associated with the same category. If events involved multiple substances from different substance categories, they were counted only once in the multiple substance category.
† Substances from different categories that were mixed or formed from a reaction before the event.
‡ Not classified.
§ All inorganic substances except for acids, bases, ammonia, and chlorine.
¶ Percentages do not total 100% because of rounding.

Police officers (77 [55%]) constituted the largest proportion of the population groups injured, followed by employees (48 [34%]) (Figure 4). In fixed-facility events, 54 emergency response personnel were injured. All of those were police officers. Police officers were injured more frequently in fixed facility-events (70%) than in transportation-related events (30%) (Figure 5).

Figure 4. - Number of victims, by population group and type of event
Missouri Hazardous Substances Emergency Events Surveillance, 2004

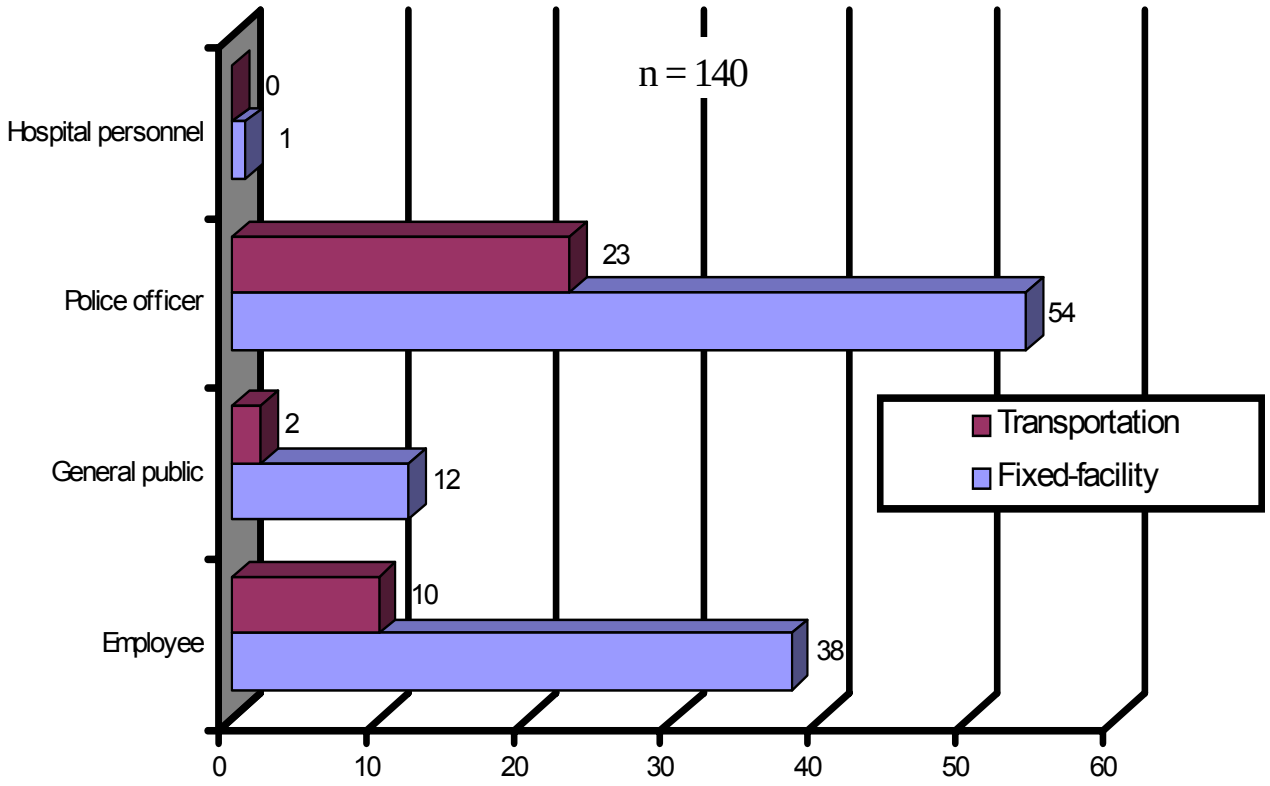
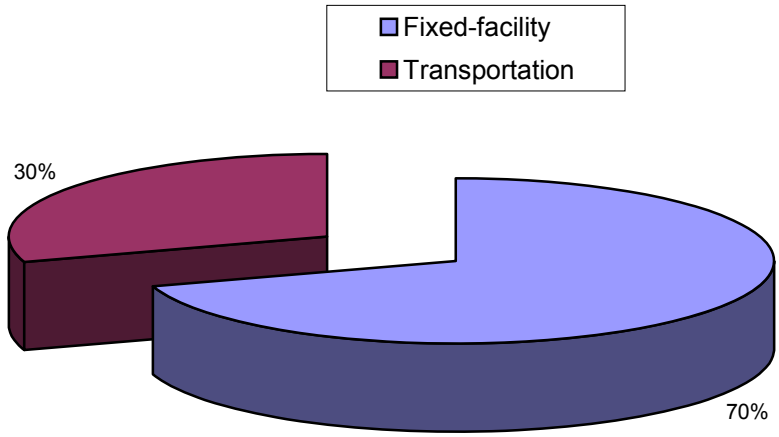


Figure 5. - Distribution of responders injured in transportation-related events, by type of responder
Missouri Hazardous Substances Emergency Events Surveillance, 2004



Victims were reported to sustain a total of 203 injuries or symptoms (Table 7). Some victims had more than one injury or symptom. Of all reported injuries/symptoms, the most common injuries/symptoms in fixed-facility events were respiratory irritation (61 [37%]), headache (42 [26%]), and dizziness/central nervous system symptoms (18 [11%]). In transportation-related events, headache (20 [53%]), trauma (7 [18%]), and respiratory irritation (6 [16%]) were reported most frequently. None of the trauma injuries in transportation-related events were substance-related; these injuries resulted from a chain of events, such as a motor vehicle accident leading to the release of a hazardous substance, and not from exposure to the substance itself.

The median age of the 53 (38%) victims for whom exact age was reported was 39 years (range: 16 - 80 years). For the 54 (39%) injured persons for whom an age category was reported, 3 (6%) were 15 - 19 years of age, 31 (57%) were 20 - 44 years of age, 16 (30%) were 45 - 64 years of age, and 4 (7%) were ≥ 65 years of age. There were no victims reported for the following age categories: < 5 years of age and 5 - 14 years of age. Of the 86 injured persons for whom age was not reported, 85 (99%) were presumably adults (because their population group was reported as responders or employees), and 1 (1%) could have been adults or children (because their population group was reported as members of the general public).

The sex was known for 122 (87%) of the victims; of these, 106 (87%) were males. Of all employees and responders for whom sex was reported, 94% were males.

Table 7. - Frequencies of injuries/symptoms, by type of event*
Missouri Hazardous Substances Emergency Events Surveillance, 2004

Injury/symptom	Fixed facility		Transportation		All events	
	No. injuries	%‡	No. injuries	%	Total no.	%‡
Chemical burns	9	5%	2	5%	11	5%
Dizziness/central nervous system symptoms	18	11%	0	0%	18	9%
Eye irritation	12	7%	1	3%	13	6%
Gastrointestinal system problems	13	8%	0	0%	13	6%
Headache	42	25%	20	53%	62	31%
Heart problems	0	0%	0	0%	0	0%
Heat stress	0	0%	0	0%	0	0%
Other	0	0%	0	0%	0	0%
Respiratory irritation	61	37%	6	16%	67	33%
Shortness of breath	0	0%	0	0%	0	0%
Skin irritation	9	5%	0	0%	9	4%
Thermal burns	1	0.6%	2	5%	3	1%
Trauma†	0	0%	7	18%	7	3%
Total	**165**	**98.6%**	**38**	**100%**	**203**	**98%**

* The number of injuries is greater than the number of victims (140) because a victim could have had more than one injury.
† Of the 7 trauma injuries all were not chemical-related.
‡ Percentages do not total 100% because of rounding.

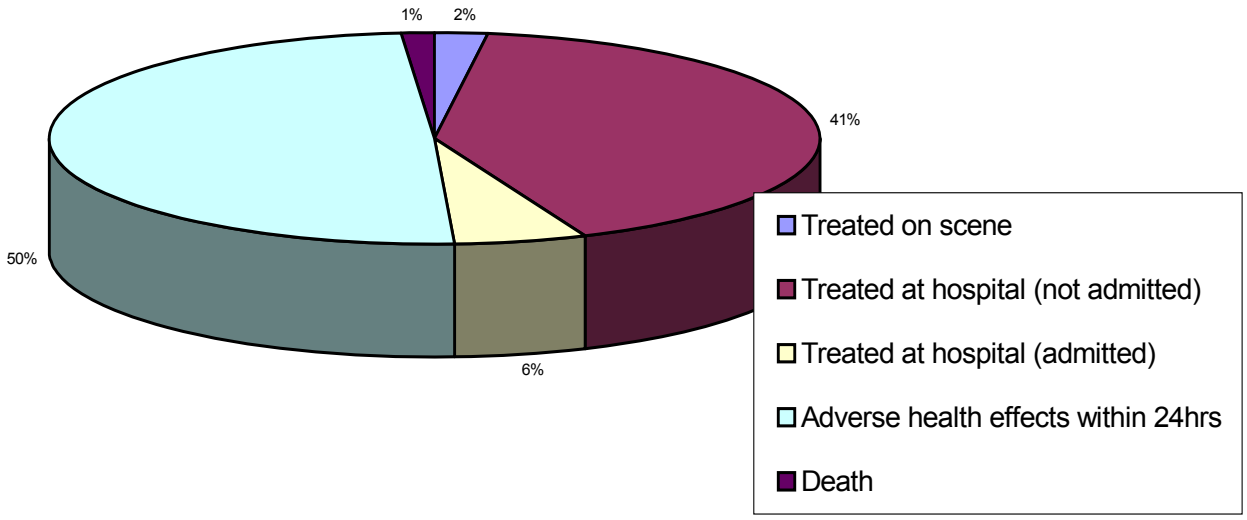
Of the 140 victims, 69 (50%) had adverse health effects within 24 hours and 58 (41%) were treated at a hospital (not admitted). Two (1%) deaths were reported (Figure 6). There were no events in which the severity was unknown.

The status of personal protective equipment (PPE) use was reported for 46 (33%) employee-victims and for 75 (54%) responder-victims. Most of the employee-victims (85%) and 15% of the responder-victims had not worn any form of PPE. Employee-victims who wore PPE most often used gloves (4 [57%]) and eye protection (2 [29%]). Among injured emergency responders who wore PPE, 41 (64%) wore gloves, and 23 (36%) wore other type(s) of PPE.*

* NOTE: Firefighter turnout gear is protective clothing usually worn by firefighters during structural firefighting operations and is similar to level “D” protection. The Occupational Safety and Health Administration defines Level D protection as coveralls, boots/shoes (chemical-resistant leather, steel toe and shank), safety glasses or chemical splash goggles, and hard hats. Level “D” provides limited protection against chemical hazards.

Only one event involved more than 10 injured people. Eleven employees were taken to the emergency room after coming in contact with chemical fumes. An aerosol can of brake parts cleaner and a duct liner adhesive, used to clean machinery, reacted together to cause a fume. The two different industrial chemicals were being used simultaneously and they produced a respiratory irritant. The employees were taken to a medical facility where they were decontaminated and treated for respiratory problems, nausea and dizziness. One employee fainted. Police, fire, emergency management personnel, and emergency medical personnel were called to the scene and the area was ventilated.

Figure 6. - Injury disposition - Missouri Hazardous Substances Emergency Events Surveillance, 2004



Nearby populations

The proximity of the event location in relation to selected populations was determined using geographic information systems (GIS) or health department records. Residences were within ¼ mile of 217 (72%) events, schools within ¼ mile of 35 (12%) events, hospitals within ¼ mile of 6 (2%) events, nursing homes within ¼ mile of 17 (6%) events, licensed daycares within ¼ mile of 42 (14%) events, industries or other businesses within ¼ mile of 158 (53%) events and recreational areas within ¼ mile of 29 (10%) events. Information for proximity of the event location in relation to selected populations was missing for 52 events.

The number of events at which persons were at risk of exposure was determined primarily using GIS. There were 205 (68%) events with persons living within ¼ mile of the event; 242 (81%) events with persons living within ½ mile; and 248 (83%) events with persons living within 1 mile. Information on the number of people living within ¼, ½, and 1 mile of the event was missing for 51 events.

Evacuations

Evacuations were ordered in 21 (7%) of 299 events where evacuation status was reported. Of these evacuations, 76% were of buildings or affected parts of buildings; 19% were of defined circular areas surrounding the event locations and 5% were of areas downwind or downstream of the event. The number of people evacuated was known for 16 (76%) events and ranged from 1 to 600 people, with a median of 13 people. In one event, 600 students were evacuated after mercury from a barometer was discovered. It is not known if the spill was an accident or the result of an end of the school year prank. The median length of evacuation was 3.3 hours (range: 1 to 32). Evacuation length was missing for 3 (14%) events. Of all 300 events, 51 (17%) had access to the area restricted. One event had in-place sheltering ordered by an official.

Decontamination

Of the 140 (100%) victims for whom decontamination status was known, 129 (92%) were not decontaminated and 11 (8%) were decontaminated at a medical facility. There was only one event in which uninjured persons were decontaminated. In this event, decontamination at the scene was done for one uninjured employee.

Response

Of the 300 (100%) events with information on who responded to the event, 32% reported 2 or more categories of personnel who responded, 16% reported 3 or more categories, and 6% reported 4 or more categories. A company's response team responded most frequently to events (50%), followed by law enforcement agency (34%), fire department (24%), and other (18%) (Table 8).

**Table 8. - Distribution of personnel who responded to the event
Missouri Hazardous Substances Emergency Events Surveillance, 2004**

Responder category	No.	%*
Certified HazMat team	21	8%
Department of works/ utilities/ transportation	0	0%
Emergency medical technicians	22	8%
Environmental agency	32	12%
EPA† response team	11	4%
Fire department	66	24%
Health department/health agency	1	0.4%
Hospital personnel	0	0%
Law enforcement agency	93	34%
Other	50	18%
Response team of company where release	137	50%
Specialized multi-agency team	0	0%
State, county, or local emergency managers/ coordinators/planning committees	0	0%

*Percentages total greater than 100% because multiple responder categories could be reported per event.
†Environmental Protection Agency.

MO HSEES 2004 Prevention Outreach Plan - Summary of Activities

Prevention Activity #1: Information collected by MO HSEES during 2003 was analyzed and incorporated into the Office of Surveillance's annual report of selected environmental diseases and conditions occurring throughout the state. This report was publicized on the Office of Surveillance's web site at http://www.dhss.mo.gov/CommunicableDisease/CDAnnualReports.html. The electronic availability of the annual report to responders, medical care providers, health agencies, and the general public may help these individuals minimize the morbidity and mortality that result from hazardous substance releases. It can also be used to help promote safer handling and lead to more effective responses to hazardous releases.

Prevention Activity #2: Quarterly reports summarizing information such as the number of events per county, risk factors, and trends have been developed for the ten counties that have the highest total number of events during the last data analysis period (1999-2001). These reports were made available to county emergency management personnel, Local Emergency Planning Commissions (LEPC), county and local fire and police departments, area hospitals, local public health agencies, and other interested parties through the HSEES web site at www.dhss.mo.gov/hsees.

Prevention Activity #3: Reports summarizing 2003 event data, such as the number of events per county, substances released, injuries, evacuations and "interesting events", were developed and made available to all target groups through the HSEES web site. Links to the reports were also included on the Department of Health and Senior Services "Community Data Profile" web page for each county.

Prevention Activity #4: An analysis that summarizes the characteristics of events involving improper loading/unloading and events involving forklift puncture was conducted. The analysis was targeted toward major transportation companies operating in MO to reduce the number of events occurring in the future as a result of these human errors.

MO HSEES 2005 Prevention Outreach Plans

Prevention Activity #1: MO added additional components to the MO HSEES website providing increased knowledge and awareness of the program to responders, medical care providers, health agencies, facilities such as transportation companies, and the general public. New and updated information on the website was publicized by mailing postcards, postings in publications and by using electronic mailing lists. Additions included, but were not limited to a comment area for feedback, information on how to report a spill, the ability to map events, and an option to sign up for the list serve to receive notification of updates. Reports and information regarding HSEES will continue to be added to the site. As enhancements to the website are made, those who have been added to the list serve will be notified.

Prevention Activity #2: Information collected by MO HSEES during 2004 was analyzed and incorporated into the Office of Surveillance's annual report of selected environmental diseases and conditions occurring throughout the state. This report was publicized on the Office of Surveillance's web site at http://www.dhss.mo.gov/CommunicableDisease/CDAnnualReports.html. The electronic availability of the annual report to responders, medical care providers, health agencies, and the general public may help these individuals minimize the morbidity and mortality that result from hazardous substance releases. It can also be used to help promote safer handling and lead to more effective responses to hazardous releases.

Prevention Activity #3: All completed analysis of MO HSEES data were only available on the MO HSEES website for viewing and printing. Although this was a good source of providing information to the public, they could not access information that may be important to their needs. With the new MO HSEES interactive mapping system, additional information is available for the viewer to select specific information for certain events in a desired location in the state. All data collected through HSEES will be analyzed and incorporated into the system. This was publicized through an electronic list serve to interested parties and the link to the system is available on the HSEES website at www.dhss.mo.gov/hsees.

Prevention Activity #4: Quarterly reports summarizing information such as the number of events per county, risk factors, and trends have been developed for the five counties that have the highest total number of events during the last data analysis period (2002-2004). These reports were made available to county emergency management personnel, Local Emergency Planning Commissions (LEPC), county and local fire and police departments, area hospitals, local public health agencies, and other interested parties through the HSEES web site.

MO HSEES 2006 Proposed Prevention Outreach Plans

Prevention Activity #1: Reports summarizing 2004 event data, such as the number of events per county, substances released, injuries, evacuations and "interesting events", will be developed and will be made available to all target groups through the HSEES web site. Links to the reports will be included on the Department of Health's "Community Data Profile" web page for each county.

Prevention Activity #2: Due to Missouri's agricultural activity, ammonia continues to be the number one hazardous substance released. An analysis will be conducted on all anhydrous ammonia events reported during 2003 and 2004. Information such as the number of events per county, substances released, injuries, evacuations and "interesting events", will be developed and will be made available to all target groups through the HSEES web site.

Prevention Activity #3: An analysis will be conducted of all methamphetamine events reported from 2002 through 2004, with specific analyses of those events involving victims who are responders. Information will be shared with law enforcement agencies and the MO Highway Patrol, along with recommendations for proper personal protective equipment and training for officers involved in the execution of search warrants or collection of evidence for suspected methamphetamine labs.

Prevention Activity #4: Quarterly reports summarizing information such as the number of events per county, risk factors, and trends will be developed for the five counties that have the highest three-year total for number of events. These reports will be made available to the county emergency management director, Local Emergency Planning Commission (LEPC), county and local fire and police departments, area hospitals, local public health agencies, and other interested parties through the HSEES web site.

SUMMARY OF RESULTS, 1994 - 2004

During 1994 – 2004, the largest proportion of events occurred in fixed facilities (Table 9). The number of reported transportation-related events increased from 1998 to 2003, then decreased in 2004. The decrease is partially due to fewer reports from the U.S. Department of Transportation's Hazardous Materials Information System.

The number of substances released has been inconsistent over the years and continues to fluctuate. The percentage of events with victims was highest in 2002 (32%) and lowest in 1995 (3%). The average percentage of events with victims during 1994 – 2004 was 17%.

Table 9. - Cumulative data by year
Missouri Hazardous Substances Emergency Events Surveillance, 1994-2004*

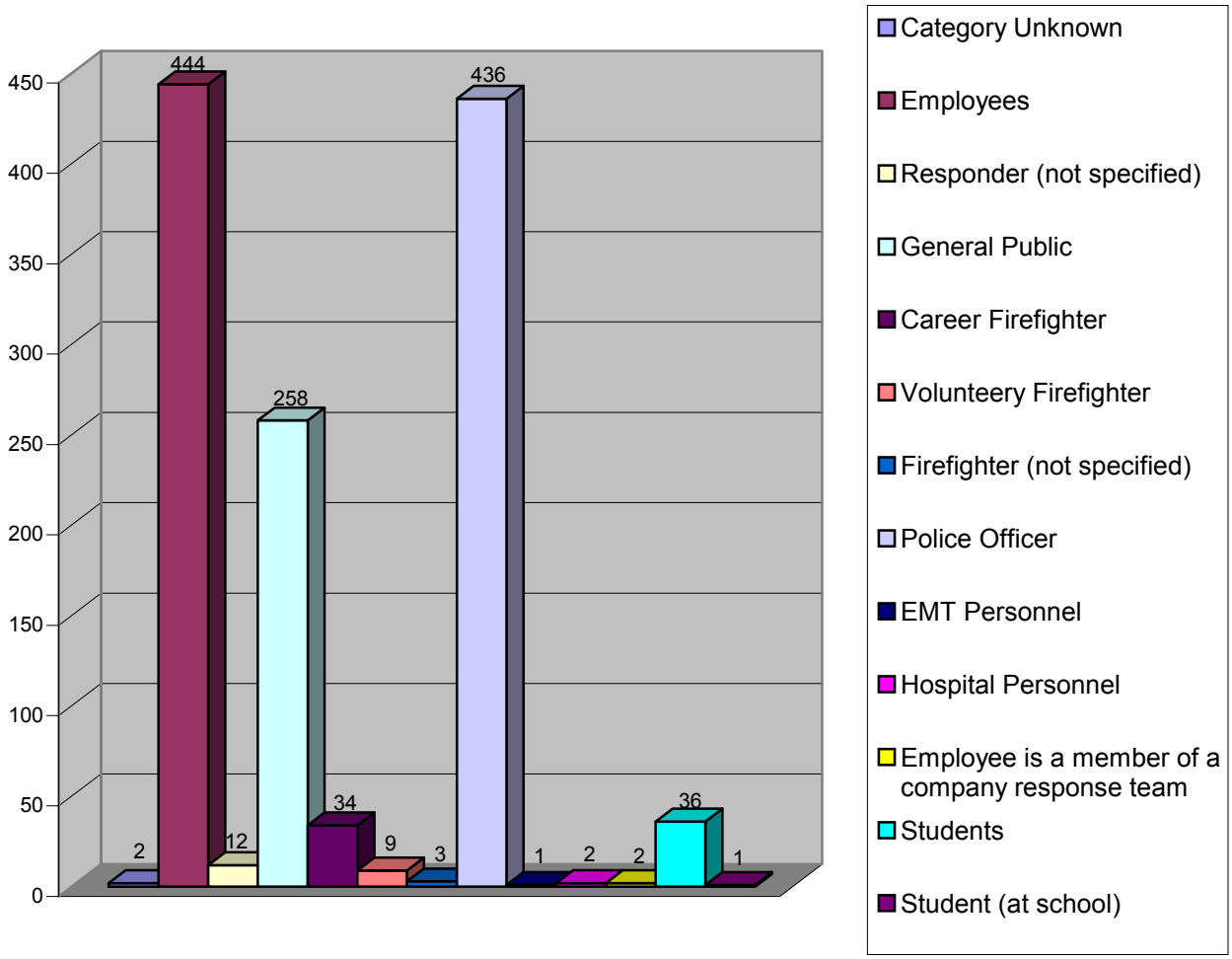
Year	Type of event		Total	No. substances released	No. victims	No. deaths	Events with victims	
	Fixed facility	Transportation					No.	%†
1994	137	67	204	231	32	1	15	7%
1995	172	156	328	360	13	1	9	3%
1996	109	51	160	175	59	2	12	8%
1997	113	70	183	216	23	1	13	7%
1998	145	51	196	197	24	2	17	9%
1999	166	125	291	312	71	3	23	8%
2000	199	162	361	486	197	14	103	29%
2001	145	160	305	369	157	3	79	26%
2002	201	193	394	501	307	5	127	32%
2003	225	205	430	575	217	3	135	31%
2004	148	152	300	403	140	2	94	31%
Total	**1760**	**1392**	**3152**	**3825**	**1240**	**37**	**627**	**20%**

* Numbers in the table may differ from those reported in previous years because of adjustments in HSEES qualification requirements for events.
† Percentage of events with victims.

Respiratory irritation has consistently been the most frequently reported injury. Employees continue to be the most commonly reported victims of acute chemical releases. However, responders constitute a large proportion of the victims as well (Figure 7). The number of injured responders has decreased from 115 in 2002 to 77 in 2004. This decrease likely results from less police officers injured when responding to events involving the manufacture of methamphetamine. This may be a result of increased awareness and training for methamphetamine lab seizures among state and local law enforcement.

The number of deaths associated with acute hazardous substances events has decreased in recent years. Many of these deaths were attributed to nonchemical circumstances causing the events (e.g., a M.V.A. resulting from high-speed travel of a truck pulling an ammonia tank).

Figure 7. - Number of victims, by category and year
Missouri Hazardous Substances Emergency Events Surveillance, 1993–2004



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1. Centers for Disease Control and Prevention. Comprehensive plan for epidemiologic surveillance. Atlanta: US Department of Health and Human Services; 1986.

2. Binder S. Death, injuries, and evacuations from acute hazardous materials releases. Am J Public Health 1989;70:1042–4.

Appendix A. - The 10 most frequent substances involved in events, Missouri Hazardous Substances Emergency Events Surveillance, 2004

Number	Standardized Substance Name	Frequency
1.	Ammonia	43
2.	Hydrochloric Acid	26
3.	Mercury	23
4.	Acetone	20
5.	Phosphorus	19
6.	Sulfuric Acid	19
7.	Sodium Hydroxide	15
8.	Methamphetamine Chemicals NOS*	13
9.	Ethyl Ether	11
10.	Proteat	10
	Total	**199**

*Not Otherwise Specified